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AUTHOR Reeve, R. A.; Brown, A. L.
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ABSTRACT

There is little doubt that intervention research based on metacognitive principles has been remarkably successful in improving children's performance on a range of academic tasks. However, to build on this success, at least three modifications need to be made in the way metacognition is usually thought about. First, more attention needs to be given to the developmental issues pertinent to intervention research, and especially to understanding the factors affecting the emergence of the conscious self-regulation of thought. Second, fundamental insights into the nature and development of metacognition require an understanding of the transition from other-regulated to self-regulated thought. Third, researchers should focus on the interaction between metacognitive processes and other self-evaluation issues. In addition, metacognitive training needs to emphasize the importance of social interactions, to treat children as coinvestigators in intervention, and to consider that children of different ages and abilities will be at different phases in the development of metacognitive skills. (FL)

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Technical Report No. 328

METACOGNITION RECONSIDERED: IMPLICATIONS FOR INTERVENTION RESEARCH

R. A. Reeve and A. L. Brown
University of Illinois at Urbana-Champaign

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University of Illinois
at Urbana-Champaign
51 Gerty Drive
Champaign, Illinois 61820

Bolt Beranek and Newman Inc.
10 Moulton Street
Cambridge, Massachusetts 02238

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Abstract

Metacognitive training techniques have been used successfully to improve childrens' problem-solving skills. The concept of metacognition needs further refinement, however, if it is to continue to be useful as an explanatory construct. Specifically, we argue that more attention needs to be paid to how metacognitive abilities are acquired, how this knowledge could be used to help improve the performance of children with learning difficulties, and how metacognition may be related to other self-evaluation processes.

Metacognition Reconsidered:
Implications for Intervention Research

The term metacognition has generally been used to refer to an individuals' ability to understand and manipulate their own cognitive processes. The inability to manipulate or control one's metacognitive processes is thought, in part, to be responsible for poor performances on academic problem-solving tasks (Brown, Bransford, Ferrara, & Campione, 1983; Brown, Campione, & Day, 1981). Metacognitive training, in the form of teaching general problem-solving principles, has been particularly successful in facilitating the intellectual performance of children with learning problems (Brown & Campione, in press; Campione & Brown, 1978, in press; Belmont & Butterfield, 1977; Palinscar & Brown, 1984; Paris, Newman, & McVey, 1982). Moreover, there is growing interest in applying metacognitive principles in modifying and training clinical "problem" behaviors (cf. Meichenbaum, 1984). We feel, however, that the notion of metacognition needs considerable refinement if it is to continue to be used as an explanatory construct by researchers and practitioners alike.

In this paper we consider how metacognitive abilities are acquired, how knowledge of that acquisition could be useful in improving the intellectual capabilities of children with special needs, and how they may be related to other self-evaluation processes. We have chosen to focus on the developmental aspects

of metacognition because we believe they have been largely ignored in training and intervention research. Moreover, rather than emphasize the weaknesses of past metacognitive theory and research, we will be forward-looking and propose a number of directions for future research.

Metacognition and the Cognitive Position

Within a cognitive framework, behavior is the outcome of a variety of mental events and processes, some of which are postulated to be under an individual's control. Central to the cognitive position is the view that the individual is an active problem-solver and processor of information, rather than a passive reactor to environmental stimuli that "impinge upon the organism." The active role ascribed to the individual is a major characteristic of the cognitive position. Moreover, it also determines the type of research that is undertaken to modify behavior and, as a consequence, the kind of interpretation used to explain behavior.

In its short history developmental-cognitive information processing psychology has undergone a number of changes with many new concepts being introduced, others refined, and still others abandoned (see Brown et al., 1983; Siegler, 1983, for reviews). Moreover, it would be a mistake to believe that the processes of change in cognitive-developmental theory are complete. Much analysis needs to be undertaken before the limits of using this framework to explain behavior can be fully assessed.

Siegler (1983) has argued that the information processing approach is, implicitly or explicitly, the leading strategy for studying cognitive development. The information processing approach stresses the importance of an individual's processing activities that underlie various aspects of thinking (e.g., remembering, problem-solving). Within this approach the way in which cognitive processing activities are coordinated is critical. In many problem-solving contexts an individual's ability to understand what is required, to understand their own capabilities, to plan strategies that will allow them to reach the goal, to monitor and coordinate these activities, are thought to be critical determinants of problem-solving success (cf. Brown, 1978).

Collectively, these problem-solving activities define what has been referred to as metacognition; that is, metacognition involves separable processes each of which could, in principle, be studied by themselves. Understanding the development of the ability to monitor, to plan, and self-regulate problem-solving activites, then, is a major goal for those interested in metacognition because the emergence of these activities contributes to the ontogenesis of effective problem-solving.

Metacognition and Intervention Training Research

A central goal of most intervention research is to ensure that the trained techniques can be used to solve problems different to those on which the skills were taught initially;

that is, the aim is the generalization of skills. Until recently, evidence for the generalization of skills was indeed the exception rather than the rule (Belmont & Butterfield, 1977; Brown et al., 1983; Borkowski & Cavanaugh, 1979; Campione, Brown, & Ferrara, 1982). In part, the lack of a transfer effect was due to adopting rigorous methodological requirements: researchers frequently kept their subjects blind to the purposes of the interventions to which they were exposed. The typical procedure in blind training studies is that children are instructed or induced to perform particular processing routines (e.g., categorizing objects for a memory test) but are not helped to understand the significance of such activities. Skill generalization was not often found under such conditions. A second reason for the failure to find skill generalization, was that training focussed on task-specific skills. Under these conditions transfer of skill did occur, but only on tasks which which were essentially the same, or very similar to those on which training had taken place.

A major break-through in cognitive skill training research occurred in the mid 1970's when researchers, especially those interested in educational processes, recognized the necessity of not only informing their clients of the purposes of training, but also recognized the importance of training task-general skills; that is, in training metacognitive skills such as planning checking, monitoring. As a result, intervention research based

on metacognitive principles has been successful, especially in improving the intellectual performance of retarded children (Borkowski & Cavanaugh, 1979; Brown, Campione, & Barclay, 1979; Brown et al., 1981). Studies that do not incorporate metacognitive training components, in contrast, are far less successful at providing durable and generalizable improvement in performance. Consistent with other training approaches, however, an aptitude by treatment interaction is frequently found in metacognitive training research, with children who are less able needing more explicit training (Day, 1980).

More recently, research based on an analysis of metacognitive principles has been conducted to determine whether they can be applied to different interest domains (e.g., improving memorizing, reading, listening, writing etc.). Training metacognitive skills to facilitate either the acquisition of, or to remedy poor skills in the text comprehension and reading domains has been particularly successful (cf. Baker & Brown, 1984; Brown, Armbruster, & Baker, in press; Campione & Armbruster, in press; Forrest-Pressley & Waller, 1984; Paris & Myers, 1981). In sum, the intervention research findings have been positive and the usefulness of metacognition as a concept well established. We now turn to a conceptual analysis of metacognition.

Conceptual Basis of Metacognition

The development of the concept of metacognition has been considered in-depth elsewhere (cf. Brown, 1975, 1978, 1982; Brown et al., 1983; Cavanaugh & Perlmutter, 1982; Flavell, 1979, 1981, 1982). Here, we briefly consider two issues. First, we point out that confusion exists over the usage of the term metacognition because its modern origins lies in two distinct research traditions. Second, the important issue of conscious control (and its development), which is implied by the term metacognitive activity, has been largely ignored by researchers.

The view that the conscious control and self-regulation of one's thought processes is an important ingredient of intelligent behavior is certainly not a new idea in psychology (cf. James, 1890). The rediscovery of the notion of metacognition, as control of thought processes, is due mainly to Flavell (1970, 1971). In the late 1960's Flavell noted that while young children were often capable of using cognitive strategies to help them remember (e.g., rehearsing to-be-remembered items) they did not often do so spontaneously. Flavell reasoned that young children did not engage task-appropriate strategies because they did not possess appropriate knowledge about memory; that is, they lacked appropriate metamemorial knowledge. Implicit in this use of the term metacognition, then, is the view that control of cognitive processing is contingent upon one's metacognitive

knowledge and the ability to reflect upon that knowledge, which is thought to begin to emerge during middle childhood (Flavell, 1979).

The second use of metacognition is embedded in an information processing approach to human thought (cf. Brown et al., 1983). Common to most information processing models is the notion that the activities of the system are guided by the operations of a central executive, the function of which is to oversee and guide problem-solving. Some of the functions attributed to the executive include planning, monitoring, checking and regulating problem-solving behavior (Brown, 1978; Brown & DeLoache, 1978). It is these self-regulatory activities of the cognitive system that have been referred to as metacognitive processes.

One critical difference between the two uses of the term metacognition is that one implies the conscious control of thinking activity, whereas the other does not. It should be noted that in recent analyses of the concept of metacognition, Flavell has argued that young children may understand that a problem calls for action, but be unable to effect a problem-solving routine; that is, they have "metacognitive experiences" but are unable to interpret these experiences (Flavell, 1981). Flavell's view, then, suggests that metacognitive processes can only be effective if an individual consciously controls them. In contrast, the metacognitive processes associated with the system

executive are thought to guide problem-solving from early childhood (cf. Brown et al., 1983). We have argued that it is the developing child's increasing ability to gain conscious control of, and to regulate their metacognitive processes that determines the growth of problem-solving skills (Brown, 1982; Brown & DeLoache, 1978).

We can only hypothesize at this time, however, what factors affect the emergence and development of conscious self-regulatory activities (cf. Brown et al., 1983). Consistent with the views of Luria (1976) and of Vygotsky (1978) we argue that awareness of self-regulatory activity has its roots in social interactions with others. Others, in the developing child's world, initially take responsibility for articulating metacognitive processes. With time, this responsibility is ceded to the child, who is required to take charge of her own thinking behaviors. Before presenting some research illustrating the relevance of this position we will consider the interactive view of metacognitive development briefly.

Origins and Growth of Metacognition

Recently, several researchers have called attention to the importance of social factors in the development of metacognitive skills. It has been suggested that the development of metacognitive skills may be facilitated by social interactions with others (e.g., teachers, parents, peers, etc.) (e.g., Brown & French, 1979; Brown & Reeve, in press; Flavell, 1979; LCHC, 1983;

Palinscar & Brown, 1981; 1984; Bereiter & Scardamalia, 1982; Wertsch, 1979). Indeed, theorists of cognitive development from different cultures have long believed that individual thought processes may have their genesis in social interactions (cf. Bruner, 1981, 1984; LCHC, 1983; Piaget, 1926; Vygotsky, 1978). Until recently, however, little attempt had been made to consider the elements necessary for a formal analysis of this problem in terms of the development of metacognitive skills (Brown et al., 1983; Brown & Reeve, in press; LCHC, 1983; Rogoff & Lave, 1984; Rogoff & Wertsch, 1984). An understanding of this problem is essential if we are to comprehend the factors that promote children gaining conscious control of, monitoring, and regulating their own mental processes.

One way to conceptualize the issue of children gaining conscious control of their cognitive processing is in terms of the transition from conscious other-regulation (parents and teachers) to conscious self-regulation. Wertsch (1979) has argued that in the preschool years the parent takes most of the responsibility in joint problem-solving (e.g, making a building out of toy blocks), often vocalizing plans and strategies, and monitoring the ongoing success of the joint venture; with development, however, the child is given more responsiblity for joint problem-solving. While this characterization captures the

idea of the transition from conscious other-regulation to conscious self-regulation, the complexity of the transition needs to be recognised.

Although parents frequently take "executive" control in playing with children, even young toddlers can exert considerable influence over an adult (see examples by Rogoff, Malkin, & Gilbride, 1984). Furthermore, even though the developing child may gain the ability to consciously regulate his or her own metacognitive processes through interactions with adults, this does not mean the child and an adult share common goals for any interaction (Brown & Reeve, in press). Wertsch (1984) has argued that one of the major changes children undergo with development is that they accept a qualitatively different interpretation of the goal of joint activity. Moreover, while the adults' role in interaction can be thought of as the expert who manages the situation by providing an appropriate cognitive scaffold which can be rearranged as a function of the child's performance, the role definition for both parent and child will change depending upon task setting. The point of identifying these issues is not to undermine the conceptualization of the development of conscious control outlined above, but to emphasize the complexities involved.

It is important to note that the teaching function of interactional situations need not be explicit, or be the central agenda of the activity. In many contexts children are initiated

into "adult" activities without explicit formal instruction (cf. Brown & Reeve, in press; Greenfield, 1984). Greenfield (1984) has examined the common features of informal instruction in several settings and has identified six common elements of "teaching": (a) the degree of aid, or scaffolding, is adapted to the learner's current state; (b) the amount of scaffolding decreases as the skill level of the learner increases; (c) for a learner at any one skill level, greater assistance is given if task difficulty increases, and vice versa; (d) scaffolding is integrated with shaping, i.e., local correction and aid are given in response to the child's current performance; (e) the aid or scaffolding is eventually internalized, permitting independent skilled performance; and finally, (f) "teachers" are often unaware of their teaching function.

We consider that learning metacognitive skills (monitoring, self-regulation etc.) among other things, involve similar elements to those outlined by Greenfield (1984). However, we would like to make several general observations about the six elements outlined by Greenfield. First, they are based on functioning, reasonably competent adults. It is clear that not all adult "teachers" would fall into this category. Moreover, some individuals, for what ever reason, will require more explicit instruction than others. Finally, a distinction ought to be made between practical everyday skills (e.g., house

cleaning) that are acquired through observational learning, and learning metacognitive skills necessary for effective problem-solving (Hatano, 1982).

This brief analysis of the social origins of metacognitive skills suggests that remedial programs aimed at fostering these skills should focus on interactive teaching procedures. Moreover, it suggests that the child/client should be regarded as a coinvestigator in gaining insight into their own metacognitive processes; a collaborative interchange is necessary to help the learner understand the cognitive goal to be strived for (Scardamarlia & Bereiter, 1982).

Interactive Metacognitive Intervention

Recently, there have been several attempts to investigate the interactive approach to teaching metacognitive skills. We will illustrate by describing two programs which are the most complete; one from our laboratory, designed to foster text comprehension and reading skills (see Brown & Palinscar, 1982, in press; Palinscar & Brown, 1984), and the other is from Scardamalia and Bereiter's laboratory, designed to improve writing skills (see Scardamalia, Bereiter, & Steinbach, 1984).

In the research on improving reading skills, junior high school poor learners, with particularly depressed reading comprehension scores, were removed from their regular reading instruction and placed in a small-group reciprocal teaching environment (cf. Palinscar & Brown, 1984 for details). In

reciprocal teaching, students of varying levels of competence and an adult teacher take turns "being the teacher," with each participant leading a dialogue on a segment of text they are jointly attempting to understand and remember. The purpose of this activity is to get the child to engage in four important metacognitive activities relevant to fostering effective reading: summarizing (self-review), questioning, clarifying, and predicting events in the text.

All of these metacognitive requirements are embedded in as natural a dialogue as possible, with the adult teacher and students giving feedback to each other. Over a several week intervention period the structure of the group interaction changed substantially. As students became better able to perform some aspects of the task, the teacher increased her demands accordingly, until the students' behavior became increasingly like that of the adult model who, in turn, decreased her level of participation and acted as a supportive audience.

We wish to emphasize three points about this research. First, it was conducted in a group context by regular classroom teachers who had been trained to use the reciprocal teaching method. Second, in practical terms, the results of the reciprocal teaching were dramatic. The students clearly internalized the types of interactions they had experienced, improving not only in their ability to paraphrase the gist and ask questions of clarification, interpretation and prediction,

but also in their ability to assume the role of the teacher, producing their own questions and summaries, and evaluating those of others. Furthermore, the intervention resulted in dramatic improvement on laboratory and classroom tests of comprehension, and on standardized tests in a follow-up investigation conducted several months after the initial interactions. Perhaps most importantly, the child's feelings of personal competence and control improved dramatically, enabling them to go farther and improve their skills on their own. Third, teaching the metacognitive skills through direct instruction techniques was far less effective than reciprocal teaching (Brown & Palinscar, in press).

Scardamalia and Bereiter's extensive research on teaching metacognitive processes in the context of improving written composition skills also demonstrates the efficacy of an interactive approach to improving metacognitive skills (see Bereiter & Scardamalia, 1982; Scardamalia & Bereiter, 1982; Scardamalia et al., 1984). In their approach novice writers are encouraged to think aloud while they attempt to write, the purpose of which is to externalize the cognitive procedures involved in writing. Scardamalia and Bereiter treat the child as a serious coinvestigator in a two-way interaction between the instructor and the child in an attempt to improve the childs skills. Typically, in their research both instructors and students model thinking aloud procedures, present cues to

stimulate self-questioning during the composition planning stage, and ask strategy questions on how to resolve conflicting ideas (see Scardamalia et al., 1984). The results of Scardamalia and Bereiter's research are encouraging. Their techniques appear to result both in an increased ability to reflect on ideas and better structured compositions.

In sum, the research from both laboratories (Brown & Palinscar, in press; Scardamalia et al., 1984) illustrates that the development of conscious self-regulation, which is necessary for the efficient use of metacognitive skills, can be taught provided the instructor takes account of the learner's entering skill level. Moreover, these data suggest that the transition from conscious other-regulated to conscious self-regulated thinking can be achieved by focussing on, and fostering the social interactive processes presumed to underlie the development of this form of conscious thought. Finally, from a practical perspective, the results of the two projects show that metacognitive principles can be used to foster academic skills (reading and writing) in the school setting; that is, training procedures, based on an analysis of the interactive aspects of metacognition, have face-validity.

Metacognition and Other Self-Evaluation Processes

So far we have emphasized the importance of social interactions in facilitating the development of the conscious self-regulation of metacognitive processes. Next, we consider an

equally important social interaction issue that has been largely ignored by metacognitive researchers; namely, the relationship between perceived self-competence, metacognitive abilities, and performance on academic tasks. The unravelling of this relationship is of utmost importance: while nothing succeeds like success, nothing fails like failure!

With few exceptions researchers interested in metacognitive development have ignored the influence of self-perceptions on performance. This seems an oversight since recent research on the development of social comparison (Ruble, Boggiano, Feldman, & Loebl, 1980), motivational (Harter, 1981), and attribution processes (Dweck & Bempechat, 1983; Dweck & Elliott, 1983) suggest that an individual's assessment of their own abilities affects performance on cognitive tasks.

As most practitioners recognize, the repeated evaluation and labeling that accompanies continuing academic failure is frequently damaging. Such children often label themselves as "dumb," "not good at school things," "can't read," "too stupid to do anything." Negative conceptions of one's prognosis for school success at best lead to the development of strategies designed to defend against exposure to evaluations that will further document one's inadequacies (Cole & Traupman, 1980). Unfortunately, these defenses also afford a formidable barrier to learning (Dweck & Elliott, 1983).

As Dweck and Bempechat (1983) have pointed out, failure-oriented children frequently attribute their errors to their lack of ability and often view temporary failure as an indication of a stable, generalized incompetence. Mastery-oriented children, in contrast, treat obstacles encountered in problem-solving as a challenge to be overcome by changing strategies, rather than attributing failures to personal shortcomings. Interestingly, mastery-oriented and failure-oriented childrens' verbalizations differ when they fail. Mastery-oriented children frequently instruct themselves to slow down, to be more systematic etc., whereas failure-oriented children typically derogate their capabilities.

Understanding the relationship between "motivational" factors and metacognitive processes is an important task, especially when working with individuals who seem particularly susceptible to a "failure" syndrome. The relationship between metacognition and motivation factors will undoubtably turn out to be complex. For example, the nature and complexity of childrens' judegments of the factors that affect perceived competence undergo change in the course of development (Harter, 1981). Furthermore, it is apparent that different aged children possess different kinds of social comparison processes and, as a consequence, draw different conclusions from failure experiences (Ruble et al., 1980).

It is unclear what underlies these developmental changes, or whether they are related to to the emergence of metacognitive processes. It is possible, however, that training the conscious self-regulation of metacognitive skills may lead the failure oriented child to focus on his or her inabilities. This may seem an overly dramatic hypothesis, but we make it to emphasize the need for research on the relationship between the development of metacognition and other self-evaluation processes.

Conclusions and Future Research Directions

In this paper we have focussed on issues in the development of metacognitive processes, and the implications of these for intervention research. There is little doubt that intervention research based on metacognitive principles has been remarkably successful in improving performance on a range of academic tasks. We have argued, however, that to build on this success at least three modifications are necessary in the way metacognition is usually thought about. First, more attention ought to be given to the developmental issues pertinent to intervention research, and especially to understanding the factors affecting the emergence of the conscious self-regulation of thought. Second, we believe that fundamental insights into the nature and development of metacognition requires an understanding of the transition from other regulated thought to self regulated

thought. Third, we think researchers should focus on the interaction between metacognitive processes and other self-evaluation issues.

We will concluded by pointing to two interrelated methodological implications of our views for future intervention research. First, metacognitive training needs to emphasize the importance of social interactions and treat the child as a coinvestigator in intervention. The goal of this procedure is to keep the child fully informed of the purposes of the interaction and to facilitate the development of the self-control of their own metacognitive skills (Brown et al., 1981). Second, assuming that the emergence of conscious self-regulation skills follows an orderly developmental course, it seems likely that children of different ages and abilities will be at different phases in the development of metacognitive skills. In addition, it is possible that metacognitive skills may, to some degree, be task dependent (see Brown et al., 1983; Chi, 1981). Having good metacognitive skills for writing, for example, does not necessarily mean that one has good metacognitive skills for reading. In practical terms, interventions which are not sensitive to the learner's current cognitive level are unlikely to be maximally effective in fostering skill development; that is, all children cannot be exposed to similar interventions. This does not mean that interventions cannot be conducted in a group context. Palinscar and Brown (1984) have shown that the reciprocal teaching

procedure can be used effectively in a group situation to foster the metacognitive skills of children with different skill entry levels.

In a recent paper, Bloom (1984) suggested that one of the most challenging problems for educational researchers is to devise group teaching techniques that are as effective as one-to-one tutoring. We consider that a reciprocal teaching methodology based on the metacognitive principles described in this paper, represents one answer to the problem posed by Bloom.

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